

greater than that of the Mucilage of Barley. Taking therefore three Fourths from Thirty-six, the Force of the Mucilage, the Remainder nine is the Force with which the Mucilage will impel the Stone ; and, consequently, the impelling Force of the Mucilage, in the Neck of the Bladder and in the *Urethra*, will be nine times greater than that of Urine ; besides the Advantage of greater Slipperiness which it gives to the *Urethra*.

III. *An Account of some Experiments, lately made in Holland, upon the Fragility of unannealed glass Vessels ; communicated to the President.*

Read Oct. 3rd. 1745. **T**HE following Paper contains the Account of several Experiments of an odd Nature, that have lately been tried both in *Italy* and in *Holland*, upon some unannealed glass Phials ; that is to say, such as have been exposed to the Air as soon as blown, without passing through the Operation that is commonly called Annealing.

The excessive Fragility of these Sorts of Glasses must have been observed, as long as the Art of making Glass has been in Use : it having been found, that almost all the Vessels that were made of such Glass were entirely useless upon that Account ; as being subject to break and fly, almost constantly, of themselves, and that even frequently before they were well cold.

It was therefore to remedy this Inconveniency that the Practice of Nealing or Annealing them was devised ;

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vised; whcreby, passing very gradually, in the Space of some Hours, through what is called the Leer, from a very intense Degree of Heat to the Temperature of the common Air, they were found to acquire such a Toughness or Tenacity, as fitted them for the several Uses for which they were respectively designed.

But some of the *Phænomena* depending upon their first Brittleness, or at least very nearly connected with it, have been often judged to deserve the Attention of the Curious. One of the first very worthy Founders of the *Royal Society*, the Right Honourable Sir Rob. Moray, very early gave in his Experiments, which appear in the Register, upon those Drops or *Lachrymæ* of Glass, which, instead of being nealed, had been immediately quenched in Water, or some other Fluid. And the same learned Person further observed, that hollow Balls, made of unnealed Glass with a small Hole in them, would fly in Picces with the Heat of the Hand only, if the small Hole, by which the internal and external Air communicated, was but stopped with the Finger.

The Glasses which the following Paper concerns, have been already mention'd to the *Society* by Mr. Baker; who, on the 31st Day of *January* last, communicated the Extract of a Letter he had then newly received from Dr. Laurentius Bruni of *Turin*,* taking notice of the same; and relating their remarkable Property of resisting very hard Strokes that were given them from without, notwithstanding they at the same time shivered to Pieces, upon the Shocks they received by

* See these *Transactions*, N°. 475, p. 272.

by the Fall of very light and minute Bodies dropped into their Cavities. And Mr. *Ellicot*, having very soon after caused some unnealed Glasses to be made here, repeated with them some of the same Experiments, which he found to answer agreeably to what Dr. *Bruni* had mentioned.

But it will further appear to be remarkable in the present Paper, that, according to the Experiments made abroad upon those Glasses, it is not the Weight alone of the Bodies severally dropped into them, which occasions their Rupture; for some certain Bodies break them with abundantly more Ease than others of the same or even much greater Weights: insomuch that such Phials as are shiver'd to Pieces by the Fall of very small Particles of Flint and some other Substances, are nevertheless capable of resisting the much greater Shock they receive, in like manner, from a leaden Bullet, tho' some Hundreds of times heavier than the Flint.

The Author of the Paper is Monsieur *Allamand*, a Gentleman of Distinction, Merit, and Learning, in *Holland*, a Person of great Curiosity, and particularly well versed in all the Parts of natural and experimental Knowledge. This Gentleman communicated his Observations to the Hon. *William Bentinck*, Esq; of the *Hague*, a worthy Member of the *Royal Society*; and who was pleased immediately not only to transmit them over to the *President*, but also to oblige him at the same time, with a Number of glafs Phials, of the very same Sort as those upon which Monsieur *Allamand's* Experiments had been made; that he might thereby be enabled both to report to the *Society* the Facts

he should take notice of, and to repeat, some of the Experiments themselves in their Prefence.

Monsieur *Allamand*'s Paper is in *French*; but the Substance of it in *English* is as follows.

Experiments made upon glass Phials, which break with the Stroke of certain Bodies; but which resist the Shocks of others, though much more ponderous.

THESE Glasses have been known some time, and an Account has already been given of them in a Dissertation printed at *Padua* in 1743: The Extract of which Dissertation, published in the *Leipzic* Acts for the Month of *February* last gave me also the Curiosity to repeat in *Holland* the same Experiments that had been already made both in *Italy* and some other Places.

These Glasses only differ from ordinary Phials in this, that they have not been set to cool gradually in what is called the nealing Furnace, but have been immediately exposed to the open Air as soon as formed. They may be made of any Shape: I have had some cylindrical with a flat Bottom, others of the Figure of a common drinking Glass, others that were conical, and others again elliptic. The Experiments have equally well succeeded upon all these several Glasses; and all that needs to be observed in the making of them is, to take care that their Bottoms may be thicker than their Sides: And, indeed, the thicker the Bottom is, the easier do the Glasses break. I had one particularly, whose Bottom

tom was above three Fingers Breadth in Thickness, and that flew with as much Ease at least as the thinnest Glass. I have had some others equally thick all over ; these have flown also, but with more Difficulty than the others.

These Glasses are capable of resisting very hard Blows coming from without : I have given to some, with a Mallet, Strokes sufficient to drive a Nail into Wood tolerably hard, and they have held good without breaking. They also resist the Shock of several heavy Bodies, that are let fall into their Cavities. Thus I have dropped, from the Height of two or three Feet, Musket-balls, Pieces of Iron, Brads, Tin, Silver, Gold, Antimony, Bismuth, Pyrites, Jasper, and several Sorts of Woods, Ivory, and Bone : All which is indeed no-ways extraordinary ; for other Glasses equally thick would also bear the Strokes of the same Bodies ; but herein consists what is more surprising.

I took a Shiver of Flint, of the Size of a small Pea ; I let it fall into the Glass from the Height of three Inches ; and in about two Seconds the Glass flew. And having repeated the same Experiment upon several other Glasses with the same Piece of Flint, the greatest Part broke in the Moment of the Shock, and the others one or two Seconds after it.

I have let fall into different Glasses a Shiver of Flint, of but half the Size of that used in the former Experiment, and the Glasses flew in the same Manner.

Another Bit of Flint, of the Size of a small Lentil, has also produced the same Effect.

Being encouraged with this Success, I let fall into one of my Glasses a Piece of Flint no larger than a Grain,

Grain of Sand : This was too light to produce any sensible Shock, and accordingly the Glass did not break. In order to try further, I shook the Glass with the small Piece of Stone in it; and nothing following, I repeated the same Experiment upon four other Glasses, none of which broke. I then judged my Experiment to have fail'd, and set by those five Glasses; but, about half an Hour after, one of those Glasses flew, and the other four soon after; insomuch that the Glass which remained the longest entire broke also, about three Quarters of an Hour after its being shook.

Tho' Flint is, of all the Bodies that I have employed, that which has hitherto broken these Glasses with the greatest Ease, it is not however the only Body that produces this *Phænomenon*.

I let fall into one a Sapphire set in a Ring; and tho' the Bottom of the Glass was near an Inch in Thickness, the Sapphire pass'd thro' it as thro' a Spider's Web. The Glass was dispersed on all Sides, and the Ring remain'd upon the Table just where the Glass rest'd.

A Bit of Porcelane, of the Thickness of half a Line, and the Breadth of two Lines, broke also several Glasses; but that only some Seconds after the Shock.

A Bit of Glass, of the same Size, produced the same Effect; and so did a very small Pebble.

Diamonds of several Sizes have constantly done the same.

A very small Piece of hard-temper'd Steel has broken all the Glasses into which I have dropped it.

One of those Pellets also that Boys play with, and which they commonly call Marbles, broke a Glass into which it was dropped; but not till four Minutes after its Fall.

Being desirous to know if the Bodies upon which I rested my Glasses contributed any thing to the Ease of their breaking, I repeated the same Experiments, holding the Glasses in my Hand, setting them upright in Clay, placing them on a Down Pillow, and putting them in Water; in all which Cases they broke in the very same Manner. I then half filled one of them with Water, and a Piece of Flint, about the Size of a Pea, broke it.

All the Bodies with which I had yet broken Glasses having been elastic without being ductile, I was willing to inquire, if those Qualities were essentially necessary, tho' I was already satisfied, that all the Bodies that had those Qualities, such as Ivory, for Example, would not produce the Effect. After many Trials, none of which succeeded, I thought of slightly rubbing the Bottoms of some of the Glasses with my Finger, and all those upon which I made that Experiment broke; tho' some of them did not fly till above half an Hour after they had been so rubbed. Thinking, that perhaps the Heat I communicated to them with my Hand might occasion their breaking, to examine whether it was so or not, I poured into several some almost boiling Water, which certainly gave them a much greater Heat than I could have given them with my Hand; but none of those Glasses broke.

I have found in the Animal Kingdom but one sort of Bodies capable of breaking these Glasses,

which are Pearls: I dropped one of near a Line Diameter into a Glass, and that Glass broke in about half an Hour.

Tho' the Experiment of rubbing with my Finger had convinced me, that the Stroke or Shock of a falling Body is not always necessary to break these Phials, I thought of scratching with a Flint the Bottom of the Glass, and the Glass immediately broke. To assure myself whether the Scratch I had made was the Occasion of its breaking, I took a Rod of Iron whose End was rounded; I push'd it strongly against the Bottom of the Glass, and the Glass flew. I then did the same, and even push'd much harder, against the Bottoms of several ordinary Glasses, but without any Effect: For tho' these Glasses were much thinner than the others, yet none of them stirred.

If the Glasses in Question are every-where extreamly thin, they do not break in the Circumstances above-mentioned; I have frequently dropped into such Glasses the same Sorts of Bodies as had broken the thicker ones, but without any Succes. I have only met with one that split: And I am not even sure but that the Weight of the Body dropped into it, which was a Stone of some Size, might occasion its breaking.

All the Phials upon which I have yet made these Experiments were of white Glass: I have not had an Opportunity of trying those made of the green.

The Author of the Dissertation, published at *Pavia* upon this Subject, pretends to account for all these singular *Phænomena* by saying: That the Bodies dropped into these Phials cause a Concussion that is stronger than the Cohesion of the Parts of the Glass; and that consequently, a Rupture of the same must ensue.

ensue. But why does not a Ball of Gold, Silver, Iron, Copper, or any of the other Bodies which I have tried unsuccessfully, tho' 1000 times heavier, equally cause this Concussion, and break the Glasses? Shall it be said, It is because they are not elastic? Copper, Iron, Silver, and Ivory, are elastic; and as much so as Flint and Porcellane; and surely much more so than the End of one's Finger.

It appears to me, that, before we undertake to give the Solution of these *Phænomena*, we should apply ourselves to the making a much greater Variety of Experiments about them; that we should both try a greater Number of Glasses, and those with a greater Variety of differing Bodies, that we may be able thence to collect at last, in what Classes the several Bodies are to be ranged, that are either fit or unfit for these Purposes: And then it may, perhaps, be Time to inquire, Whether it is from the Principles of Chemistry, or from those of Mechanics, or any other Branch of Natural Philosophy, that we are to seek for the Reasons of the several Facts.

AFTER the reading of this Paper, the *President* produced before the *Society* several of the Phials themselves, which he had received from *Holland*, together with some others he had caused to be made at Mr. *Ceile's* Glass house in *White-Fryars*. He acquainted the Company, that he had yet made himself but few Trials of these Glasses, as he was desirous to preserve them till he could have the Satisfaction of shewing them to the *Society*, and repeating some of Monsieur *Allamand's* chief Experiments in their Presence: That he had designedly broken only four of his
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foreign Phials; in all which Matters had succeeded agreeably to the foregoing Relation; and that a fifth, into which he had dropped a leaden Bullet, had flown of itself, about a Quarter of an Hour after; but whether from any Operation of the Bullet, or from the Heat of the Room only, he could not take upon himself to determine.

After this, he proceeded to make a good Number of Experiments upon the Phials; by all which it appeared,

That none of them, either foreign or *English*, were broken by the Shock of a leaden Bullet weighing 12 Pennyweight: tho' the same was let fall from the Height of above two Feet.

That all the foreign Phials, and several of the *English*, into which a Shiver of Flint, of the Weight of three Grains, was let fall, and that from a Height of only 2 Inches, were broken; most of them instantaneously, and the others within two or three Seconds.

That several of them were broken with a small Shiver of their own broken Glass; but that, generally, this Operation was not so quick, the Phials sometimes not flying till two or three Minutes after the Shock.

That several of them were shiver'd immediately, by the Shock of a small Piece of harden'd Steel broken off from a steel Rod of about half a Quarter of an Inch in Thickness.

That of two Phials, into which a Boy's playing Marble was dropped, the one broke presently, and the other not till three or four Minutes afterwards.

That

That of the two Phials rubbed with the Finger on the Inside of the Hollow, the one did not break, but the other did, about five Minutes after.

That one of them did not break with the Fall of a rough *Cornish* Diamond into it, tho' the Experiment was twice repeated; but that the same afterwards was immediately broken by the Flint.

That the Trials made upon *English* Glasses, tho', seemingly, of the same Sort, did not succeed quite so well, and so certainly, as those made upon the foreign ones; which were, probably, more suddenly cooled, as the Workmen already acquainted with their Properties, may be more expert in their Management of them.

Upon the Whole, all the Company were perfectly satisfied of the Truth and Exactness of Monsieur *Allamand's* Experiments; and order'd their Thanks to be recorded both to that Gentleman and Mr. *Bentinck*, for these very curious Communications.

Mr. *Allamand* observes, that he had yet only tried these Experiments upon Phials made of white or crystal Glass. But the *President* since received from the Reverend Dr. *Littleton, F. R. S.* some large hollow Cups, made at *Worcester*, of the common green Bottle Glass; all which, tho' of a much greater Size than the others, and some of them above three Inches thick at Bottom, were instantly broken with a Shiver of Flint weighing but about two Grains; tho' they had before resisted the Shock of a Musket-ball from the Height of near three Feet.

N. B. That all the foreign Glasses mentioned in this Paper were nearly of the Shape represented in TAB. I. *Fig. 1.* and about four Inches in Height.

IV. *Extract of a Letter from the Reverend Henry Miles, D. D. & F. R. S. to the President, relating to some Improvements which may be made in Cyder and Perry.*

The Letter read Nov. 1745. **T**HE Design of communicating the following Paper to the *Royal Society* is, to invite Gentlemen, after the Example of a Practice that has long obtained in *Herefordshire*, to attempt an Improvement of their waste Lands, by planting such kind of Fruit trees, as are mentioned, in Hedges and barren Places; which, for aught appears, would thrive as well in other Counties, perhaps in some Parts of most Counties in *England*, as in that of *Hereford*.

Extract from a Manuscript, written Anno 1657-8, by Mr. afterwards, Dr. John Beale, & F. R. S. in the Way of an epistolary Address to S. Hartlib, Esq; for his Use and that of Mr. Pell, the then British Resident at Zurich; and which appears to have been intended as a Sequel to that scarce and valuable Piece intituled Herefordshire Orchards, inserted in the later Editions of Mr. Bradley's New Improvement of Planting, &c.

Concerning

Fig. 2.
p. 541.

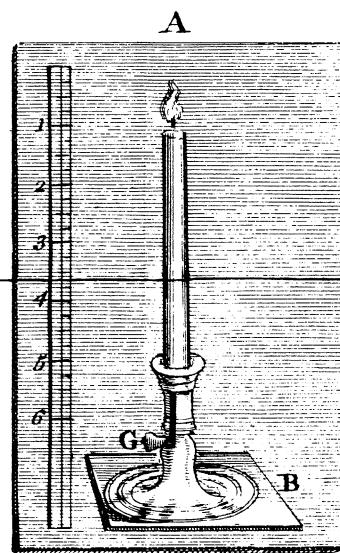


Fig. 3.
p. 556.

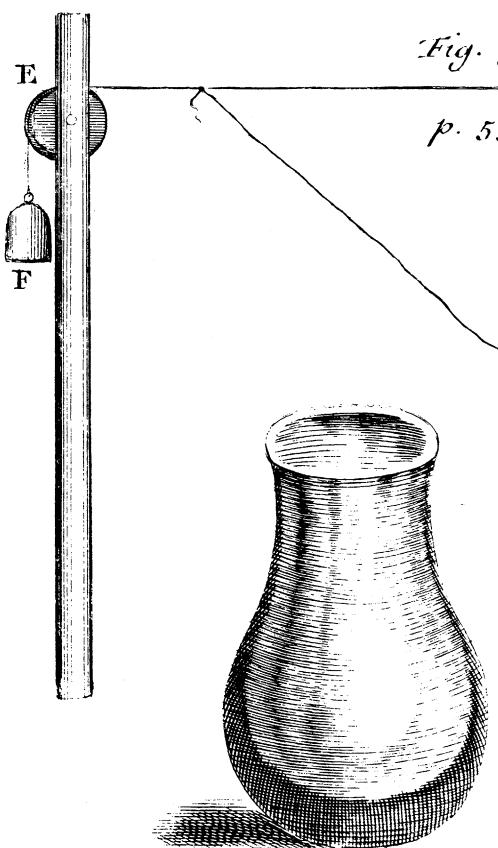
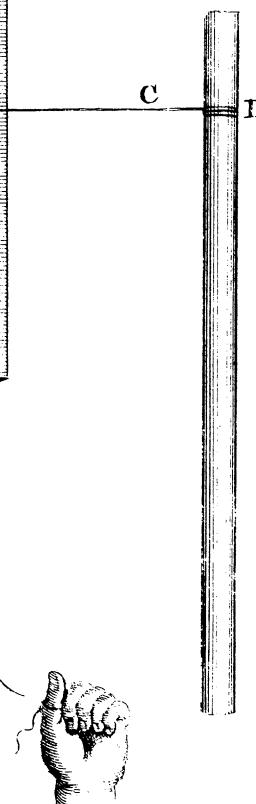


Fig. 1. p. 516.



GENIO ET HONOR
L·POMPEI·LF·POLHEREN
NIANI·EQ·ROM·EQ·PVB·
Q·AER·PETALIM·AE DIL·
IIVI RO·CVRATORI·
KALENDARIOR·REI·P
COLLEGIVM PASTO
PHORORVM·INDVS
TRIENSIVM·PATRO
NO·OB·MERITA·

T · G · B · A · E · T R O P H I U M V S · I N D · F A C ·

